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1 Running head: IS VARIETY A SPICE

2

3 Is Variety a Spice of (an Active) Life?: Perceived Variety, Exercise Behavior, and the Mediating

4 Role of Autonomous Motivation

5

Abstract

In this study, we examined whether *perceived variety in exercise* prospectively predicts unique variance in exercise behavior when examined alongside satisfaction of the three basic psychological needs (for competence, relatedness, and autonomy) embedded within self-determination theory (Ryan & Deci, 2002), through the mediating role of autonomous and controlled motivation. A convenience sample of community adults ($N = 363$) completed online questionnaires twice over a six week period. The results of structural equation modelling showed perceived variety and satisfaction of the needs for competence and relatedness to be unique indirect positive predictors of exercise behavior (through autonomous motivation) six weeks later. In addition, satisfaction of the need for autonomy was found to negatively predict controlled motivation. Perceived variety in exercise complemented satisfaction of the needs for competence, relatedness, and autonomy in predicting motivation and (indirectly) exercise behavior, and may act as a salient mechanism in the prediction of autonomous motivation and behavior in exercise settings.

Key words: self-determination theory, motivation, variety, psychological needs satisfaction, physical activity

Is Variety a Spice of (an Active) Life?: Perceived Variety, Exercise Behavior, and the Mediating Role of Autonomous Motivation

Participating in regular exercise is highly beneficial for psychological and physical functioning (Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010; World Health Organization, 2010). However, recent evidence indicates that as little as 15% of Canadian adults meet current physical activity guidelines (Colley et al., 2011). As such, understanding exercise behavior and the mechanisms that predict involvement in exercise is a critical issue. A prominent line of enquiry for advancing our understanding of the amount of exercise people engage in has involved investigation of the psychosocial factors they experience in exercise contexts (Teixeira, Carraça, Markland, Silva, & Ryan, 2012).

One factor that has recently garnered attention for understanding individuals' exercise behavior is *variety* (e.g., Juvancic-Heltzel, Glickman, & Barkley, 2013). The experience of variety (i.e., felt variety) refers to a person's *perception* of whether they have experienced (or currently experience) variety, and is characterized by feeling as though one pursues and experiences diverse (i.e., novel or alternating among familiar) activities, behaviors, and opportunities in their social environment (cf. Kahn & Ratner, 2005; Sheldon & Lyubomirsky, 2012). Varied experiences stimulate interest (via novelty; Silvia, 2006) and reinforce learning and development (via alternation among familiar experiences; e.g., Magill & Hall, 1990). Variety has been previously examined as a feature of the activity or environment (e.g., Lyubomirsky & Layous, 2013), however the *experience* of variety is conceptually distinct from the provisions that facilitate the experience of variety (i.e., variety support). The experience of variety in one's social environment refers to the subjective assessment of one's felt experience whereas variety support refers to one's subjective perception(s) of the way that activities, behaviors and opportunities are structured to promote (or thwart) the

experience of variety in a given social setting. The *experience of variety* (i.e., one's felt experience) is the focus of investigation in the present paper.

In the context of exercise, researchers have found that when people experience variety, this prospectively predicts their subsequent behavior (Glaros & Janelle, 2001; Juvancic-Heltzel et al., 2013). For example, in Glaros and Janelle's (2001) study, when people varied the type of aerobic exercise that they engaged in every two weeks, they had greater adherence to their exercise sessions than people who did the same aerobic exercise each session. Furthermore, Juvancic-Heltzel and colleagues (2013) found that providing people with the opportunity to experience more variety (i.e., ten versus two options of equipment to use) resulted in longer duration of time spent exercising and a greater amount of repetitions performed.

In terms of *how* and *why* varied experiences may be related to behavior, it is noteworthy that the experience of variety has been found to be innately stimulating and rewarding in and of itself (i.e., intrinsically gratifying; Berlyne, 1970; Kahn & Ratner, 2005; Pronin & Jacobs, 2008), and people volitionally engage in meaningful behaviors they find to be personally interesting and enjoyable (Ryan & Deci, 2002; Kahneman, 1999). Conceptualizing variety as an antecedent of intrinsic motivation has been highlighted by researchers in organizational psychology through the job characteristics model described by Hackman and Oldham (1976). Hackman and Oldham illustrated that the extent to which a person experiences different activities and uses multiple skills and talents at work, leads to a psychological state of 'meaningfulness', which subsequently supports intrinsic motivation. In support of the link between variety and intrinsic motivation, the appraisal of something (e.g., an experience) as being new, unfamiliar, and diverse is one of the main appraisals upon which interest is built (e.g., Silvia, 2006). In the exercise psychology literature the provision of opportunities for people to experience variety has been found to be related to their enjoyment and intrinsic motivation (Silva et al., 2010). Moreover, emphasizing that one can expect variety has also

been found to be positively related to a greater internal perceived locus of causality in exercise settings (Dimmock, Jackson, Podlong, & Magaraggia, 2013), which includes both intrinsic motivation *and* internalized forms of extrinsic behavioral regulation (Ryan & Deci, 2000). Along with interest and enjoyment, the extent to which someone has an internal perceived locus of causality broadly describes their autonomous motivation in a given context (Ryan & Deci, 2002; Dimmock et al., 2013), which is theorized to be a high quality and volitional type of motivation that leads to engagement and persistence in activities (Ryan & Deci, 2002). Indeed, autonomous motivation could be an important mechanism (i.e., reason) that explains how and why the experience of variety is related to behavior.

In their review on the pursuit of varied experiences, Kahn and Ratner (2005) called for researchers to move beyond piecemeal atheoretical approaches, by drawing from theory to examine the effect of variety in relation to a range of salient outcomes, including motivation and behavior. One theory that may provide insight regarding whether experiencing variety develops and maintains autonomous motivation and exercise behavior is self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2002). Within SDT, Deci and Ryan (1985, 2008) contend that the degree to which people experience satisfaction of the basic psychological needs for competence, relatedness, and autonomy, supports (or restricts) subsequent autonomous motivation and persistence in behavior. However, Sheldon (2011) highlighted that the three basic psychological needs advanced within SDT are perhaps an incomplete subset of psychosocial experiences that may explain variance in salient outcomes such as motivation and behavior. By examining the experience of variety concurrently with satisfaction of the psychological needs proposed within SDT, we can gain insight into any potential novel contributions that experiencing variety may offer in the prediction of autonomous motivation and behavior.

Conceptually, the experience of variety (i.e., feeling as though one pursues and experiences diverse activities, behaviors, and opportunities in their social environment) is unique from satisfaction of each of the basic psychological needs as competence refers to an individual's perception of their ability to be effective in their social environment (Ryan & Deci, 2002; White, 1959), relatedness refers to feelings of attachment, companionship, and connectedness with other people (Baumeister & Leary, 1995; Ryan & Deci, 2002), and autonomy refers to feelings of choice, volition, and feeling in charge of one's decisions and actions (deCharms, 1968; Ryan & Deci, 2002). For example, a participant in an exercise class may feel as though s/he experiences variety (via performing novel exercises or alternating among familiar exercises) without feeling competent in their performance, related to those with whom they exercise, or autonomous in the exercises they perform. In a recent study, Sylvester et al. (2014) found that in the context of exercise, perceived variety in exercise is an empirically distinct psychological experience from the satisfaction of the needs for competence, relatedness, and autonomy. More specifically, the authors found that perceived variety in exercise (along with perceptions of competence, relatedness, and autonomy) predicted unique variance in indices of exercise-related well-being and, through the use of factor analyses, the variance in perceived variety in exercise was not subsumed by satisfaction of the basic psychological needs.

In addition to supporting exercise-related well-being, perceived variety in exercise may further complement perceptions of competence, relatedness, and autonomy in exercise by explaining unique variance in autonomous (internalized) exercise motivation. As previously discussed, perceived variety in exercise may promote autonomous motivation through interest, enjoyment and an internal perceived locus of causality (Dimmock et al., 2013). Beyond autonomous motivation, Ryan and Deci (2002) also emphasize the importance of considering controlled motivation, which has yet to be examined in relation to perceived variety. Controlled motivation is characterized by

partial internalization of a value without fully accepting it as one's own, and being motivated by external rewards and punishments (Ryan & Deci, 2002). For example, people who exercise to avoid feelings of guilt and/or to attain accolades are acting out of controlled motivation. Overall, autonomous motivation involves a higher degree of internalization than controlled motivation; Ryan and Deci (2002) postulate that autonomous (but not controlled) forms of motivation will result in increased behavioral outcomes such as greater performance and sustained persistence over time (Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Ryan, Williams, Patrick, & Deci, 2009).

Evidence supporting the relationships between satisfaction of the needs for competence, relatedness, and autonomy, autonomous motivation, and exercise behavior has been tested and supported in exercise settings (Teixeira et al., 2012). Furthermore, satisfaction of the three psychological needs in exercise settings has been found to positively predict exercise behavior, and autonomous (but not controlled) motivation has been found to mediate that relationship (e.g., Barbeau, Sweet, & Fortier, 2009; Silva et al., 2010).

Experiencing variety in exercise may be a unique predictor (when examined alongside satisfaction of the needs for competence, relatedness and autonomy) of autonomous motivation and exercise behavior because (a) the expectation (but not the experience) of variety in exercise has been found to be related to indices of autonomous motivation (Dimmock et al., 2013), (b) variety support has been found to explain variance in exercise behavior (Glaros & Janelle, 2001; Juvancic-Heltzel et al., 2013), and (c) the experience of variety has been found to be empirically distinct from perceptions of competence, relatedness, and autonomy in the context of exercise (Sylvester et al., 2014). However, the extent to which the experience of variety in exercise explains unique variance (alongside perceptions of competence, relatedness, and autonomy) in exercise behavior via autonomous motivation has not yet been examined. In the present study, the experience of variety in exercise was examined at the same *level* as satisfaction of the needs for competence, relatedness, and

autonomy because perceived variety in exercise is also conceptualized as a felt experience that precedes both autonomous motivation (e.g., Dimmock et al., 2013) and exercise behavior (e.g., Glaros & Janelle, 2001), has enduring effects on psychological functioning (Sheldon, Boehm, & Lyubomirsky, 2012), and has affective consequences (cf. Sheldon, 2011; Sylvester et al., 2014). It is also noteworthy that it was not our aim to test variety as a basic psychological need in the present work as there are numerous criteria that must be established before a construct can be considered a psychological need (e.g., psychological needs are universal, apply across cultures, and are not necessarily consciously valued; Ryan & Deci, 2002).

The purpose of the present study was to examine whether perceived variety in exercise (along with perceptions of competence, relatedness, and autonomy) prospectively predicts unique variance in exercise behavior over time, and whether autonomous and controlled motivation mediate that relationship in the context of exercise. Based on previous research (e.g., Dimmock et al., 2013; Glaros & Janelle, 2001; Juvancic-Heltzel et al., 2013; Sylvester et al., 2014) and SDT (Ryan & Deci, 2002), we expected that perceived variety in exercise (along with satisfaction of the needs for competence, relatedness, and autonomy) would explain unique variance in autonomous motivation and exercise behavior over a 6 week period, and that variance in exercise behavior would be explained (i.e., mediated) by autonomous motivation. In a test of discriminant validity, we expected that in the context of exercise, perceived variety (along with satisfaction of the needs for competence, relatedness, and autonomy), would have a negative or non-significant effect on controlled motivation and controlled motivation would have a negative or non-significant effect on exercise behavior (Ryan & Deci, 2002; Teixeira et al, 2012; see Figure 1 for the path diagram of the relationships examined).

Methods

Participants

Participants ($N = 363$) were a community sample of adults (i.e., 18 to 83 years of age) ¹.

Eight cases were deleted due to missing values (i.e., respondents failed to provide any information regarding their behavioral regulations in exercise). The ensuing sample included 246 females ($M_{age} = 35.43$ years; $SD_{age} = 13.90$ years) and 117 males ($M_{age} = 35.58$ years; $SD_{age} = 14.81$ years). At the first time point, 47.7% of participants were single while 46.8% were married; the majority were Caucasian (79.9%), and residents of Canada (95.6 %). Most participants had completed at least a college diploma or university degree (73%), had full or part-time employment (64.7%), and had an annual household income less than \$100,000 (73.3%).

Procedure

Once ethical approval for this study was obtained from the [REDACTED] institutional review board, adults (i.e., at least 18 years of age) able to read and converse in English were invited to contact the first author (via e-mail) through posters in the community (e.g., community centers), online postings (e.g., a blog), and in person (e.g., at recreational events) to obtain more information or express their interest in participating. We used a prospective observational design, and e-mailed an online questionnaire to consenting participants on two occasions, six weeks apart. Demographic information, perceived variety in exercise, and basic psychological needs satisfaction were measured at Time 1, while autonomous and controlled motivation, and exercise behavior were measured at Time 2. The questionnaires took approximately 15 minutes for participants to complete. To thank participants for their time, they were entered into a draw to win one of six \$50 gift certificates.

Measures

Perceived variety in exercise. The Perceived Variety in Exercise (PVE) questionnaire (Sylvester et al., 2014) was used to assess participants' perceived variety in exercise. An example item includes "I feel like I experience variety in my exercise". Items on the PVE questionnaire were

anchored on a 6-point Likert-type rating scale with responses ranging from 1 (False) to 6 (True). Higher scores reflect greater levels of perceived variety in exercise. Sylvester et al. provided evidence for the factorial validity of scores derived from the PVE questionnaire whereby (a) support was found for a four-factor measurement model (including perceived variety in exercise, and satisfaction of the needs for competence, relatedness, and autonomy in exercise), and (b) perceived variety in exercise was found to be empirically distinct from perceptions of competence, relatedness, and autonomy. The ordinal composite reliability (Zumbo, Gadermann, & Zeisser, 2007) estimate for the perceived variety in exercise scores used in the current study was .97.

Basic psychological needs satisfaction. The Psychological Need Satisfaction in Exercise (PNSE) questionnaire (Wilson, Rogers, Rodgers, & Wild, 2006) was used to measure satisfaction of the psychological needs for competence, relatedness, and autonomy in the context of exercise. Examples of items that characterized each of the psychological needs include “I feel capable of completing exercises that are challenging to me” (perceived competence; 6 items), “I feel connected to the people who I interact with while we exercise together” (perceived relatedness; 6 items) and “I feel free to exercise in my own way” (perceived autonomy; 6 items). Responses to each item were anchored on a scale that ranged from 1 (False) to 6 (True). Higher scores reflect greater levels of psychological needs satisfaction in exercise. In the current study, the scores were integrated to create a latent variable for each unique construct. Ordinal composite reliability (Zumbo et al., 2007) estimates for scores from each need satisfaction subscale were .96 for competence, .96 for relatedness, and .95 for autonomy.

Autonomous and controlled motivation. The Behavioral Regulations in Exercise Questionnaire-2R (BREQ-2R; Wilson, Rodgers, Loitz & Scime, 2006) was used to assess current behavioral regulations in exercise. The BREQ-2R is a 23-item self-report instrument that was developed to measure the quality of one’s exercise motivation along a continuum of internalization

(Wilson et al., 2006). The BREQ-2R includes the following subscales: (a) Intrinsic regulation (e.g., “I enjoy my exercise sessions”; 4 items); (b) Integrated regulation (e.g., “I consider exercise a fundamental part of who I am”; 4 items); (c) Identified regulation (e.g., “I consider exercise consistent with my values”; 4 items); (d) Introjected regulation (e.g., “I feel guilty when I don’t exercise”; 3 items); (e) External regulation (e.g., “I exercise because other people say I should”; 4 items); (f) Amotivation (e.g., “I think exercising is a waste of time”; 4 items). Each item was rated on a 5-point Likert scale anchored from 0 (Not true for me), to 4 (Very true for me). Previous research has supported the internal consistency (i.e., Cronbach’s α) of scores for each of the subscales of the BREQ-2; Longbottom, Grove, & Dimmock, 2012).

Scores from the items were used to form latent variables reflecting autonomous and controlled motivation. Consistent with tenets of SDT (Deci & Ryan, 2008), and previous research in this area (e.g., Barbeau et al., 2009), the latent variable of autonomous motivation, was comprised of items reflecting intrinsic, integrated, and identified regulations, and the latent variable of controlled motivation included items reflecting introjected and external regulations. Amotivation was excluded from analyses because it is theorized to reflect a lack of motivation which was not of interest in this particular study. Ordinal composite reliability (Zumbo et al., 2007) estimates for the scores used in each latent variable were .96 for autonomous motivation and .88 for controlled motivation.

Exercise behavior. Exercise behavior was assessed using the Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985). The GLTEQ is comprised of 3-items regarding leisure-time exercise and asks participants about the frequency (on average) of mild (e.g., minimal effort), moderate (e.g., not exhausting) and strenuous (e.g., heart beats rapidly) exercise lasting at least 15 minutes per session during a typical 7-day period at that point in time. To examine exercise behavior that was conducive to promoting psychological and physical functioning, mild activities were not included in the analysis as Godin (2011) suggested that only moderate and strenuous

activities (i.e., not mild activities) contribute to health. A score was calculated using the formula $[(\text{Moderate} \times 5) + (\text{Strenuous} \times 9)]$ to produce typical weekly estimates of leisure-time exercise with higher scores reflecting higher levels of energy expenditure (Godin, 2011). Supporting the validity evidence of GLTEQ scores, Godin and Shephard (1985) found higher scores to have positive correlations with estimates of cardiorespiratory fitness (i.e., VO_2max) and negative correlations with high body fat scores. Score stability has been examined through test-retest reliability coefficients which have been found to range from .24 to .96 (Godin & Shephard, 1985; Jacobs, Ainsworth, Hartman, & Leon, 1993).

Data Analysis

In the present study, the hypothesized model (see Figure 1) was tested using *Mplus* 6.11 software to account for the ordered categorical nature of the Likert-type response scale scores. A weighted least squares mean and variance-adjusted (WLSMV) method of estimation was used because the data were ordinal (Finney & DiStefano, 2006). When data are treated as ordinal, a polychoric correlation matrix is modelled in the analyses and is the best option for modeling Likert-type responses when the number of response categories are less than seven (Beauducel & Herzberg, 2006; Muthén, 1993). We used multiple categorical items to construct latent variables for perceived variety (five items), satisfaction of the needs for competence (six items), relatedness (six items), and autonomy (six items), as well as autonomous motivation (twelve items) and controlled motivation (seven items). The outcome variable of exercise behavior was operationalized as an observed variable. In addition, participants' gender was included as a covariate in relation to exercise behavior to control for potential differences in exercise behavior between men and women (cf. Colley et al., 2011).

To assess the measurement reliability of the scores, we used composite reliability (CR) in which each item is individually weighted in the composite load (see Bollen, 1989). Ordinal

composite reliability is based on the polychoric correlation matrix and was assessed to account for the Likert-type response formats used in the PVE, PNSE, and BREQ-2R (Zumbo et al., 2007). We measured CR using the formula $CR = \sum (\text{std. loadings})^2 / \sum (\text{std. loadings})^2 + \sum (1 - \text{std. loadings})^2$ (Fornell & Larcker, 1981). The structural model included tests of correlations as well as direct and indirect predictive pathways between perceived variety, competence, relatedness, and autonomy at Time 1, and autonomous and controlled motivation, and exercise behavior at Time 2 (see Figure 1). To assess the fit of the model to the data, we examined the χ^2 goodness of fit index, along with the comparative fit index (CFI), Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA; Brown, 2006; Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004). Acceptable model-data fit was designated as CFI and TLI values $> .90$, and RMSEA values $< .08$, and excellent fit was designated as CFI and TLI values $> .95$ and RMSEA values $< .06$ (Brown, 2006; Hu & Bentler, 1998, 1999; Marsh et al., 2004). Although we recognize that there has been considerable debate in terms of what constitutes acceptable cut-off values for approximate fit indexes (e.g., CFI, RMSEA), or whether fit indices can even be used to supplement the chi-square statistic (e.g., Barrett, 2007; McIntosh, 2007), our approach aligns with that presented by Brown (2006) and Marsh et al. (2004) who recommend providing multiple sources of information to guide model evaluation.

In line with Baron and Kenny's (1986) conceptual approach to describing mediation, we estimated the relationships between the predictors (i.e., perceived variety, competence, relatedness, and autonomy in exercise) and the mediators (i.e., autonomous and controlled motivation), the effects of the mediator variables on the outcome variable (i.e., exercise behavior), and the direct effect of the predictors on the outcome variable after controlling for the mediators. Consistent with contemporary approaches to testing mediation (i.e., Rucker, Preacher, Tormala, & Petty, 2011) the main outcome of interest was the indirect effects of perceived variety, competence, relatedness, and

autonomy on exercise behavior through autonomous and controlled motivation which were calculated via Preacher and Hayes' (2007; 2008) bootstrapping procedure ($k = 5000$ samples) to produce bias corrected confidence intervals. In line with Preacher and Hayes (2008), we used bias corrected bootstrapped confidence intervals within a structural equation modeling framework to allow for covariation of autonomous and controlled motivation (i.e., latent mediators), reduce the likelihood of Type 1 error, and increase statistical power.

Results

Descriptive statistics for the (observed) outcome variable, exercise behavior, were as follows:

$M_{\text{moderate-vigorous exercise}} = 38.23$ units; $SD = 23.24$; skewness = .671 ($SE = .128$); kurtosis = .475 ($SE = .255$). The fit indices for the model were: $\chi^2(883) = 2662.59$, $p < .001$, CFI = .96, TLI = .95; RMSEA = .075, 90% CI [.071, .078]. Interfactor correlations between all study variables ranged from -.14 to .61 (see Table 1). With regards to the structural relations, perceived variety ($\beta = .227$, $p < .001$), and satisfaction of the needs for competence ($\beta = .315$, $p < .001$) and relatedness ($\beta = .267$, $p < .001$) positively predicted autonomous motivation, while satisfaction of the need for autonomy ($\beta = -.203$, $p < .01$) negatively predicted controlled motivation over a six week period (see Table 2). Furthermore, autonomous motivation positively predicted exercise behavior ($\beta = .254$, $p < .001$), and controlled motivation was not a significant predictor of exercise behavior ($\beta = .011$, $p > .05$). Additionally, gender ($\beta = -.165$, $p < .01$) directly predicted exercise behavior (see Figure 2) with men reporting more exercise behavior than women.

With regard to the main findings, total indirect effects were found to be significant for the relationships between perceived variety ($\beta = .057$, $p < .05$) and satisfaction of the needs for competence ($\beta = .078$, $p < .05$) and relatedness ($\beta = .067$, $p < .01$) on exercise behavior (see Table 3). More specifically, perceived variety ($\beta = .058$, $p < .01$) and satisfaction of the needs for competence ($\beta = .080$, $p < .05$) and relatedness ($\beta = .068$, $p < .01$) had unique indirect effects on exercise

behavior through autonomous motivation. After statistically controlling for the effects of autonomous and controlled motivation (i.e., mediators), the direct effects (see Table 2) for perceived variety ($\beta = .102, p = .155$) and satisfaction of the needs for competence ($\beta = .081, p = .396$) and relatedness ($\beta = .019, p = .768$) in relation to exercise behavior were non-significant, which provides evidence of the mediating effects of these variables.

Discussion

The purpose of this study was to examine the extent to which perceived variety in exercise (along with satisfaction of the needs for competence, relatedness, and autonomy in exercise) prospectively predicts exercise behavior, and the extent to which that relationship is mediated by autonomous and controlled motivation in the context of exercise. The results of this study revealed that perceived variety in exercise was a unique indirect positive predictor of exercise behavior, and autonomous motivation mediated that relationship. Furthermore, satisfaction of the needs for competence and relatedness also positively predicted exercise behavior indirectly through autonomous motivation, while satisfaction of the need for autonomy was a negative predictor of controlled motivation.

The results regarding perceived variety in exercise are consistent with past work that has found exercise-related variety support to predict exercise behavior (Glaros & Janelle, 2001; Juvancic-Heltzel et al., 2013). These results are also consistent with those of Dimmock et al. (2013) who reported that expectations of variety in exercise were related to autonomous (i.e., internalized) motivation. We extended their work by testing and finding support for a theoretical mediator (i.e., autonomous motivation) that explains the relationship between perceived variety and behavior in exercise. Overall, perceived variety in exercise was found to complement satisfaction of the needs for competence, relatedness, and autonomy by explaining unique variance in the prospective prediction of autonomous motivation and (indirectly) exercise behavior.

Consistent with SDT (Ryan & Deci, 2002), in the current study satisfaction of the needs for competence and relatedness were positively related to exercise behavior, and those relationships were mediated by autonomous motivation. Contrary to our a priori theorizing, satisfaction of the need for autonomy was not a significant predictor of either autonomous motivation or exercise behavior. Unfortunately, our data do not provide insight into the possible reasons for why the satisfaction of the need for autonomy in exercise did not explain variance in these variables. However, as a potential explanation, some researchers have found that in the context of exercise, when statistically controlling for satisfaction of the needs for relatedness and competence, satisfaction of the need for autonomy no longer predicts autonomous motivation (e.g., Sweet, Fortier, Strachan, & Blanchard, 2012; Wilson & Rogers, 2008). With regards to controlled motivation, our results indicated that satisfaction of the need for autonomy in exercise was a negative predictor, which is also consistent with previous research (e.g., Silva et al., 2010).

Since the experience of variety in exercise was found to be related to both autonomous motivation and indirectly to exercise behavior, but unrelated to controlled motivation, perceived variety may be more related to the *promotion* of autonomous motivation and exercise behavior than protecting against the experience of controlled motivation. This finding is in line with the notion that experiencing variety in exercise may promote interest and enjoyment in exercise and facilitate the internalization of exercise behavior (Dimmock et al., 2013). In light of the finding that the experience of variety was able to explain unique variance in autonomous motivation, the results of this study lend weight to Sheldon's (2011) contention that satisfaction of the three basic psychological needs subsumed within SDT (i.e., competence, relatedness, and autonomy) may be an incomplete subset of the types of positive experiences that are involved in supporting autonomous motivation. Although this study was restricted to the context of exercise, it would seem worthwhile to examine the extent to which the experience of variety is able to account for unique variance in

autonomous motivation and relevant behaviors in other contexts of human functioning such as eating/diet, friendship interactions, and work experiences.

Despite the theoretical and empirical contributions of the present study, limitations should also be acknowledged. While using a broad community sample for this study holds merit, participants were a convenience sample (e.g., those interested in a study about exercise), which restricts the external validity of the conclusions. While administering questionnaires online for this study reduced participant burden and study costs, an exclusive reliance on self-report data limits our conclusions, as complementary objective measures of exercise behavior (e.g., the use of accelerometers) would have provided data for an additional (more robust) test of predictive utility. By using a prospective observational design, we were able to draw conclusions regarding the relationships between exercise-related perceived variety, satisfaction of the needs for competence, relatedness, autonomy, motivation and exercise behavior over time. However, the observational (i.e., non-experimental) design prevents inferences of causality. In future research, experimental designs are encouraged to examine the social contextual supports that give rise to perceived variety in exercise as well as the potential causal link between perceived variety, autonomous motivation and behavior in exercise contexts.

Consistent with the tenets within SDT (Ryan & Deci, 2002), Vallerand (1997) suggested that in given contexts (e.g., exercise, sport, leisure) the way in which the social context is structured and the interpersonal interactions experienced within serve to either satisfy or frustrate particular psychological experiences (e.g., within SDT ‘basic psychological needs’; Ryan & Deci, 2002). That is, need-supportive social contexts are hypothesized to satisfy a person’s basic psychological needs and subsequently promote autonomous motivation and behavior (Standage & Vallerand, 2014). In contrast, need-thwarting social contexts are assumed to frustrate an individual’s basic psychological needs and lead to controlling forms of motivation and/or passive engagement in activities (Standage

& Vallerand, 2014). Of direct relevance to the current discussion is that in future an important line of inquiry would be to examine the extent to which the provision of variety within the social context (i.e., exercise-related variety support) is related to the perception of exercise-related variety (i.e., felt variety), as well as downstream measures of autonomous motivation toward exercise and exercise behavior. By examining these relationships experimentally and/or in a mediation model (i.e., exercise-related variety support → perceived variety in exercise → autonomous motivation toward exercise → exercise behavior), researchers can gain insight into the extent to which the provision/availability of exercise-related variety support (i.e., opportunity), results in the felt experience of variety (i.e., perceived variety in exercise) independent of, or (possibly) in combination with, the satisfaction of the needs for competence, relatedness, and autonomy in exercise. Such an endeavor would also shed light on the extent to which variety support is related to subsequent exercise behavior, as well as a more comprehensive analysis of the different mechanisms (i.e., mediational pathways) that might explain that relationship. In line with SDT (Ryan & Deci, 2002) and Vallerand's (1997) hierarchical conceptualization of these tenets, we would hypothesize that exercise-related variety support would best predict an individuals' perceived variety in exercise (i.e., as when compared with the satisfaction of the needs for competence, relatedness, or autonomy in exercise), which would in turn explain variance in exercise behavior (mediated through autonomous motivation toward exercise). We encourage researchers to test this hypothesis. Should research provide evidence for such an effect, this would point to the utility of targeting exercise-related variety support through intervention as a means of bolstering autonomous motivation and exercise behavior.

In conclusion, the results of this study provide insight into how/why perceived variety in exercise relates to exercise behavior. That is, when examined alongside satisfaction of the needs for competence, relatedness, and autonomy, perceived variety in exercise explained unique variance in

1 exercise behavior via autonomous motivation. As such, we suggest that researchers examine the
2 antecedents of the perception of variety in exercise to understand how to facilitate this potentially
3 beneficial psychosocial experience. With regards to external validity, examining perceived variety in
4 relation to motivation and behavior in other contexts (e.g., perceived variety with regard to sport
5 training or educational/learning opportunities) would be an insightful line of enquiry. Researchers
6 should continue to examine potential theoretical and applied implications that perceived variety may
7 hold.

Footnotes

¹ The data reported in the present study is part of a larger program of research designed to examine the effects of perceived variety in exercise contexts. Research on item development, and reliability and validity evidence of scores derived from the PVE questionnaire was previously published in [REDACTED] and included data on perceived variety, competence, relatedness, and autonomy in exercise collected at Time 1 and data on exercise-related well-being at Time 2. In the present study, we examined Time 1 scores of perceived variety, competence, relatedness, and autonomy in exercise, in relation to Time 2 (i.e., 6 week later) scores of autonomous and controlled motivation in exercise, and exercise behavior.

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Table 1. Interfactor correlations

Variable	1	2	3	4	5	6	7
1. Variety-T1	--						
2. Competence-T1	.56*	--					
3. Relatedness-T1	.35*	.54*	--				
4. Autonomy- T1	.16*	.46*	.26*	--			
5. Autonomous Motivation-T2	.50*	.61*	.53*	.31*	--		
6. Controlled Motivation-T2	-.22*	-.33*	-.20*	-.30*	-.22*	--	
7. Exercise Behavior-T2	.30*	.36*	.26*	.26*	.40*	-.14*	--

Note. T1 = Time 1; T2 = Time 2; * = $p < .01$.

Table 2. Direct Effects of Predictors and Mediators

Variables	Standardized Estimates	Unstandardized Estimates	Standard Errors	<i>p</i> -values
<i>Predictors on Autonomous Motivation</i>				
Variety	.227	.204	.048	< .001
Competence	.315	.314	.069	< .001
Relatedness	.267	.280	.050	< .001
Autonomy	.062	.075	.072	.298
<i>Predictors on Controlled Motivation</i>				
Variety	-.083	-.074	.069	.283
Competence	-.167	-.165	.095	.081
Relatedness	-.033	-.034	.073	.640
Autonomy	-.203	-.242	.089	.007
<i>Predictors and Mediators on Exercise Behavior</i>				
Variety	.102	2.521	1.772	.155
Competence	.081	2.213	2.605	.396
Relatedness	.019	0.533	1.809	.768
Autonomy	.123	4.092	2.185	.061
Gender	-.165	-7.386	2.345	.002
Autonomous Motivation	.254	6.974	1.994	< .001
Controlled Motivation	.011	0.317	1.840	.863

Table 3. Indirect Effects of Perceived Variety, and Satisfaction of the Needs for Competence, Relatedness, and Autonomy on Exercise Behavior, through Autonomous and Controlled Motivation

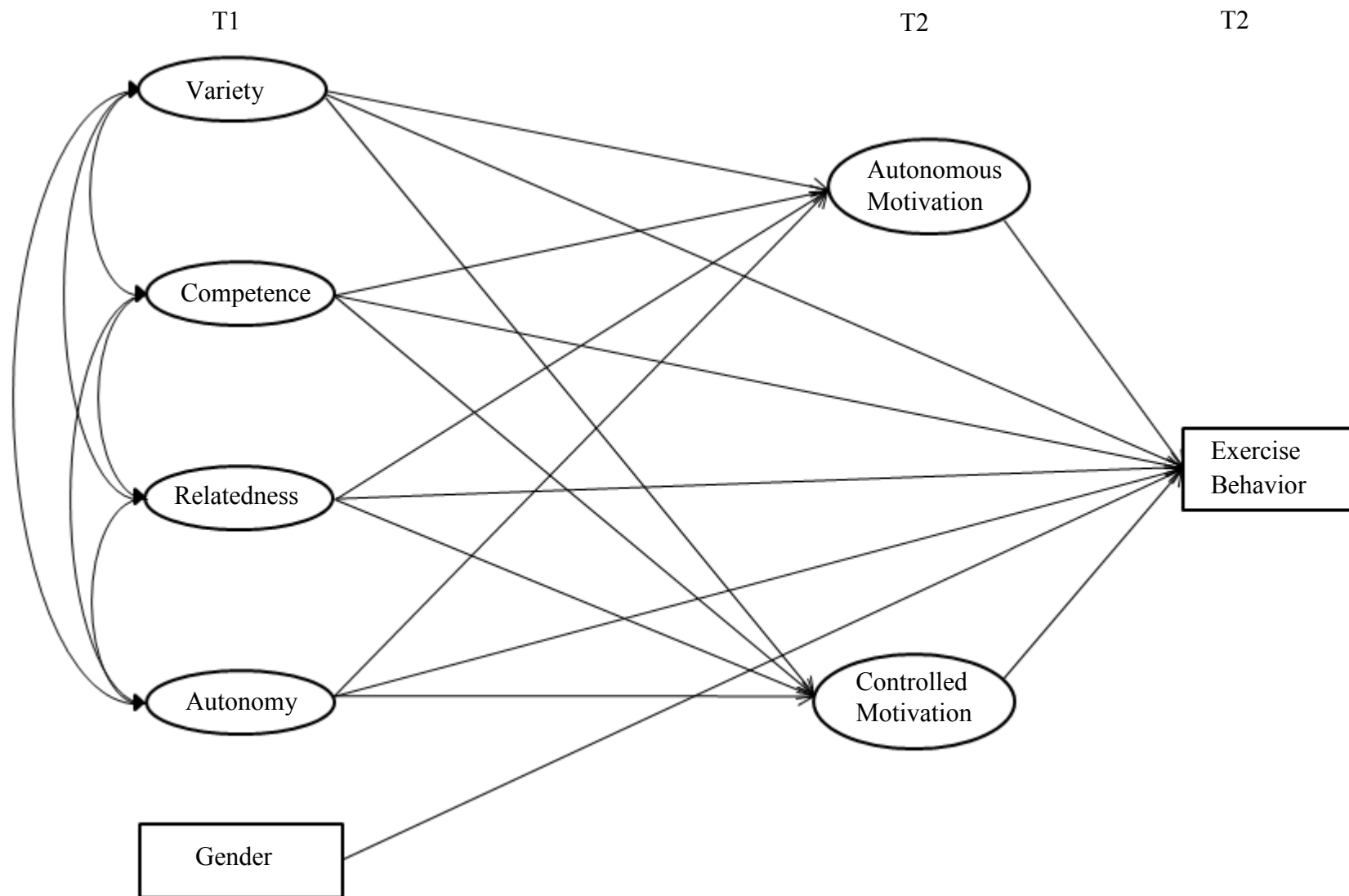
Variables	Estimate	SE	<i>p</i> -Value	Bias Corrected Bootstrapped 95% Confidence Interval
<i>Variety to Exercise Behavior</i>				
Total Indirect Effects	.057	.025	.025	.007 – .106
Specific Indirect Effects				
Autonomous Motivation	.058	.021	.007	.016 – .099
Controlled Motivation	-.001	.010	.925	-.021 – .019
<i>Competence to Exercise Behavior</i>				
Total Indirect Effects	.078	.035	.027	.009 – .147
Specific Indirect Effects				
Autonomous Motivation	.080	.031	.011	.019 – .141
Controlled Motivation	-.002	.013	.887	-.028 – .024
<i>Relatedness to Exercise Behavior</i>				
Total Indirect Effects	.067	.023	.004	.022 – .113
Specific Indirect Effects				
Autonomous Motivation	.068	.022	.002	.025 – .110
Controlled Motivation	.000	.006	.951	-.012 – .012
<i>Autonomy to Exercise Behavior</i>				
Total Indirect Effects	.013	.023	.551	-.031– .058
Specific Indirect Effects				
Autonomous Motivation	.016	.016	.313	-.015 – .046
Controlled Motivation	-.002	.015	.874	-.031 – .026

Note. Standardized beta coefficients are reported.

Figure Captions

Figure 1. Path diagram of the relationships examined between perceived variety, competence, relatedness, and autonomy in exercise at Time 1 (T1), and autonomous motivation, controlled motivation and exercise behavior at Time 2 (T2). Gender was included as a covariate of exercise behavior.

Figure 2. Path diagram of the relationships between perceived variety, competence, relatedness, and autonomy in exercise at Time 1 (T1), and autonomous motivation, controlled motivation and exercise behavior at Time 2 (T2). Gender was included as a covariate of exercise behavior. Solid lines represent (standardized) significant path coefficients and dashed lines represent non-significant path coefficients. * $p < .05$, ** $p < .01$.



Is Variety a Spice
T2

